

The Ascidians of Point Barrow, Alaska, Part I

Suborder Phlebobranchia (Enterogona)

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DURING THE YEARS 1948 to 1951 sizeable collections of ascidians were made by workers at the Arctic Research Laboratory, Point Barrow, Alaska. Most of the specimens were dredged during the summers of 1948 to 1950 under the supervision of Professor G. E. MacGinitie of the California Institute of Technology, in the course of an extensive survey of the distribution and ecology of the marine invertebrates of Point Barrow.² This material was forwarded to me for study through the kindness of Professor MacGinitie and of Drs. Paul Illg and Fenner A. Chace, Jr., of the Smithsonian Institution, U. S. National Museum. Additional small collections of ascidians were made in 1950–1951 by Dr. Ira L. Wiggins and Mr. James Böhlke of Stanford University; these have been made available to me by Miss Margaret Storey of the Natural History Museum, Stanford University. It is a pleasure to express my thanks to those named above.

A general account of the environment and marine invertebrate fauna of Point Barrow is now available (MacGinitie, 1955). This gives complete locations and descriptions of dredging stations 1–62 (MacGinitie, 1955: 60–85, fig. 1), and includes some information on the distribution and ecology of the ascidians (pp. 180–183). The ascidian names used by MacGinitie are based on determinations made by myself. MacGinitie's locality records are more comprehensive than those included here, for he has listed some records resulting from field identifications (using determined comparison specimens) of material which was not preserved for later study. In the present systematic account I

have cited only specimens which I have examined personally.

The collections contained 27 ascidians belonging to the suborder Phlebobranchia, representing 3 species: *Ascidia callosa*, *Chelyosoma macleayanum*, and *C. inaequale*. The first 2 species are familiar arctic forms; while well known, much remains to be learned of their variability. *C. inaequale* is previously known only from 10 specimens, plus three very dubious records from deep water off southern California and Panama (Van Name, 1945: 209). Collecting data on the material examined are listed in Table 1.

In the following section the references listed are limited to a few earlier works which have made important contributions or which contain good descriptions or extensive bibliographies on the species concerned. The descriptions given are intended to supplement, not duplicate, the existing accounts cited for each species.

ORDER ENTEROGONA

SUBORDER PHLEBOBRANCHIA

FAMILY ASCIDIIDAE

- Ascidia callosa* Stimpson, 1852
Ascidia adhaerens Ritter, 1901, pp. 227–230, pl. 27, figs. 1–5.
A. (Ascidiopsis) columbiana Ärnback, 1934, pp. 53–55, text figs. 13–14.
A. callosa Hartmeyer, 1924, pp. 41–53; Huus, 1930, pp. 1–11, figs. 1–6; Ärnback, 1934, pp. 49–52, pl. 4, 6, figs. 19–26, 43–44, text fig. 12; Van Name, 1945, pp. 178–180, pl. 4, fig. 5, text figs. 92–94.
Ascidiopsis columbiana Huntsman, 1912, pp. 110–113, pl. 10, fig. 5, pl. 14, figs. 5, 7, 8.

DESCRIPTION: The following notes supplement the description given in Van Name

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TABLE 1

COLLECTING STATION DATA ON PHLEBORANCHIATE ASCIDIANS EXAMINED
Stations 20-61 were occupied by MacGinitie, stations B51-31 to B51-33 by Böhlke

STATION NUMBER	DATE	DEPTH (ft.)	TYPE OF BOTTOM AND REMARKS (after MacGinitie, 1955)	SPECIMENS EXAMINED		
				<i>Ascidia callosa</i>	<i>Chely- osoma macleay- anum</i>	<i>Chely- osoma inaequale</i>
20	9 Sep 48	125	stones (sea urchins, <i>Psolus</i> , sea anemones)	3		
23	15 Sep 48	130	stones (sea anemones, <i>Psolus</i> , sea urchins)		3	
26	9 Aug 49	130	stones, gravel			1
27	9 Aug 49	420	stones, gravel	1		1
32	17 Aug 49	741	mud (worm tubes)	1		
36	6 Sep 49	477	few rocks (worm tubes)		1	
37	6 Sep 49	227	stones, large perforated rocks		4	
42	6 Oct 49	216	rocks, stones (<i>Psolus</i> , sea urchins)	2		
44	11 Oct 49	453	rocks, stones, small amount of gravel (<i>Psolus</i>)	1	2	1
45	11 Oct 49	341	stones, gravel, few rocks (sea urchins)		1	
61	5 Aug 50	204	mud, stones, gravel	1		
B51-31	29 Jul 51	151			1	
B51-32	29 Jul 51	164			2	
B51-33	29 Jul 51	144			1	

(1945). Tunic highly variable with size, age, and environment; in smaller specimens less than 1 mm. thick, membranous, colorless, transparent, smooth or slightly tuberculate, sometimes papillate about the apertures; in larger individuals up to 9 mm. thick, gelatinous to cartilaginous, dirty tan to olive brown, often wrinkled and encrusted with debris. Siphons ranging from very short to nearly one-third of the total body length. Oral aperture with 6-8 lobes, atrial with 6 lobes; some individuals with orange pigment spots between adjacent lobes on both siphons. Tentacles of 3 or 4 sizes, variable in number (Table 2), and regular to irregular in arrangement. Dorsal tubercle usually with a U-shaped slit, the opening sometimes canted toward the left; horns of the slit conspicuously outrolled in the largest specimen examined (sta. 44). Internal longitudinal vessels variable in number (Table 2), bearing both regular and intermediate papillae (the latter often irregularly distributed). Transverse

vessels of 5 orders present in larger specimen from sta. 42, the smallest order being parastigmatic, irregularly distributed, incompletely developed, and corresponding in position to the intermediate papillae of the internal longitudinal vessels. Stigmata 2-20 per mesh. Renal vesicles forming a conspicuous layer of small bladders, particularly on the gut and adjacent mantle on the left side. Gonads well developed only in the 3 specimens from sta. 20 (1 specimen, only 11 mm. long, bore a single row of large eggs in its oviduct), all of these with developing larvae in the atrial chambers.

DISCUSSION: This species has often been confused with *Ascidia obliqua* and *A. prunum*, which also occur in arctic waters. It differs from *A. obliqua* in bearing intermediate papillae on the internal longitudinal vessels and in its possession of abundant renal vesicles. It is distinguished from *A. prunum* most conspicuously by its much smaller number of internal longitudinal vessels and by its habit of brooding

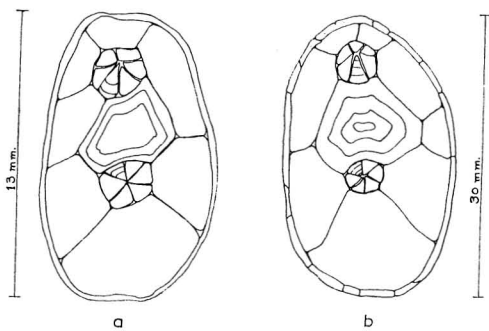


FIG. 1. *Chelyosoma macleayanum*. Dorsal view of disc; growth lines indicated only on intersiphonal plate and two siphonal plates. *a*, Individual with 7 marginal plates; *b*, individual with 8 marginal plates.

embryos and immature larvae within the atrial cavity.

The tentacle counts for the 4 largest specimens (Table 2) are higher than those usually obtained in *A. callosa*, although Ärnback (1934: 53) records similar numbers. The difference here is probably not significant. Tentacle counts vary a good deal depending on the degree of development of a fourth cycle of very small tentacles; in the present study these tentacles were counted when present, whereas earlier workers have often ignored or overlooked them in making counts.

The specimen from 741 ft. (123 fathoms) represents an unusual depth record for the

species; Van Name (1945: 180) indicates a maximum depth for *A. callosa* of about 80 fathoms.

DISTRIBUTION: Norway, N. Ireland (?), the Faeroes, Iceland, Greenland, eastern N. America south to Cape Cod, arctic N. America, western N. America south to Puget Sound, Bering Sea, and Korea.

FAMILY RHODOSOMATIDAE

Chelyosoma macleayanum Broderip & Sowerby, 1830

Fig. 1*a, b*

Chelyosoma macleayanum Huntsman, 1921, pp. 27–33, pl. 1, fig. 1, text fig. 1; Hartmeyer, 1924, pp. 2–9, text fig. 36; Ärnback, 1934, pp. 76–84, pl. 5, figs. 27–33; Van Name, 1945, pp. 205–207, text fig. 118.

DESCRIPTION: The following notes supplement the description of Van Name (1945). Dorsal disc of test divided into plates arranged as follows: 6 triangular plates forming a ring about each aperture; remainder of disc bearing 1 central intersiphonal plate and 7 or 8 marginal plates, the 8th marginal plate, when present, occupying an asymmetric position to the right of the center of the intersiphonal plate (Fig. 1); lateroventral plates below rim of disc

TABLE 2
Ascidia callosa

STATION NUMBER	DIMENSIONS (mm.)	ORAL LOBES	ATRIAL LOBES	TENTACLES	INTERNAL LONGITUDINAL VESSELS		
					Right	Left	Total
20	11× 6× 1*	8		32	19–20	16	35–36
27	14× 9× 4	8	6	24			
20				26	19	14	33
42	14×10× 4	8	6				
61	16×16× 5	7	6	70†	20	16	36
32	33×24×12	7	6	ca. 50	18	16	34
42	41×28×13	6	6	ca. 65	17–18	19	36–37
44	75×53×35			ca. 55	26	23	49

* Measured on animal removed from tunic; all other size measurements in table made on intact animal in tunic.
† Fourth order tentacles unusually numerous.

TABLE 3
Chelyosoma macleanum

STATION NUMBER	LENGTH OF DISC (mm.)	NUMBER OF MARGINAL PLATES ON DISC	NUMBER OF GROWTH LINES ON PLATES OF DISC
23	—	7	—
23	—	7	—
36	3	8	0
23	7	8	—
44	8	7	2
37	8	8	2
44	8.5	7	2
B51-32	10	8	2
37	11	8	2
45	12	8	2
B51-33	12	8	2
B51-32	13	7	2
37	14	8	1?
37	17	8	3
B51-31	30	8	3

indistinct or absent except in largest specimen (disc 30 mm. long); 0-3 growth lines present on plates of disc. Quantitative information is presented in Table 3.

DISCUSSION: All of the specimens of this well-known arctic species obtained at Point Barrow are assigned to the form *typica* (Ärnback, 1934), which is characterized by possession of a single central intersiphonal plate and 5-9 marginal plates. Van Name (1945) considers the individuals with 7 more or less symmetrically placed marginal plates (Fig. 1a) to represent the normal condition, and this appears to be the case in northern Atlantic waters, but Ärnback has described a population from Pitlekaj on the Siberian arctic coast (67° 7' N., 173° 24' W.) in which the modal number of marginal plates is 8, the 8th plate being located on the right as in the Point Barrow specimens. The sparse comparative data available (Table 4) suggest a zoogeographic cline with respect to number of marginal plates, and a re-examination of earlier collections of *C. macleanum* with this possibility in mind should prove worthwhile.

Growth lines on the test plates show a general increase in number with the size of the animal (Table 3), and suggest that the largest individuals taken were in their 4th year (see Huntsman, 1921).

DISTRIBUTION: Circumpolar arctic: Russia, Norway, Iceland, Greenland, eastern N. America south to Cape Ann, arctic N. America, Bering Strait, Sea of Okhotsk, Siberian arctic.

Chelyosoma inaequale Redikorzev, 1913
Figs. 2, 3a-e

C. inaequale Redikorzev, 1913, pp. 206-208, fig. 2; Ärnback, 1934, pp. 80-81; Van Name, 1945, p. 209.

DESCRIPTION: Body elongate-oval, the dorsal surface flattened to form an oval disc bearing the siphons and surrounded by a marginal ridge whose prominence varies with degree of body contraction. Both apertures 6-lobed. Tunic tough, flexible, translucent, grey-white to yellowish, locally thickened to form triangular plates on all siphon lobes (Fig. 3b) and a conspicuous array of warts, ridges, and small plates on the disc and marginal ridge, giving the dorsal surface a tessellated appearance (Figs. 2, 3a). Internal surface of tunic bearing a ridge below

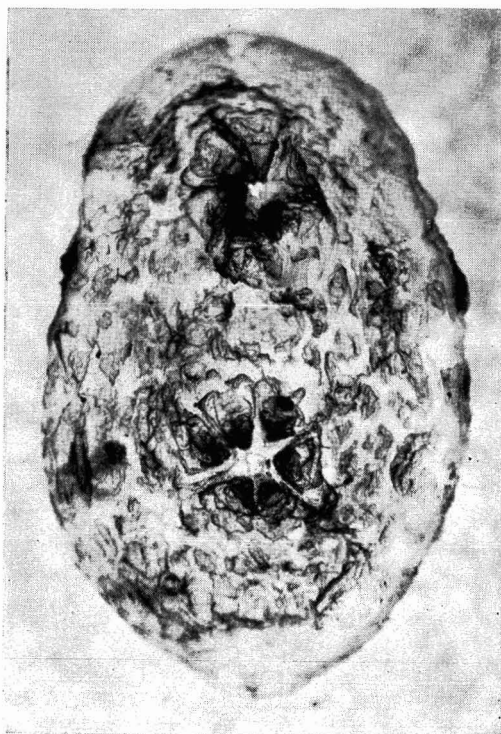


FIG. 2. *Chelyosoma inaequale*. Dorsal view of disc.

TABLE 4
Chelyosoma macleayanum, PER CENT OF POPULATION BEARING SPECIFIC NUMBERS OF MARGINAL PLATES

REFERENCE AND LOCATION	NUMBER OF SPECIMENS EXAMINED	NUMBER OF MARGINAL PLATES					
		5	6	7	8	9	Uncertain
		%	%	%	%	%	%
Hartmeyer, 1924; material mostly from Greenland.....	53	2	9	79	2	0	8
Present collections; Point Barrow, Alaska.....	15	0	0	33	67	0	0
Ärnäck, 1934; material from Siberian arctic, mostly Pitlekaj.....	185	0	0	11	87	2	0

each siphonal plate and numerous papillae dorsally and dorsolaterally to which mantle muscles attach. Mantle thin, with muscles strongly developed about the siphons and below the marginal ridge of the disc but nearly absent elsewhere. Tentacles simple, of 2–4 orders (Table 5). Dorsal tubercle with a crescentic slit (Fig. 3*c*); 20–40 dorsal languets of 1 or 2 sizes (Fig. 3*c*; Table 5). Pharynx relatively complex and thick-walled (Fig. 3*d*); 18–31 internal longitudinal vessels on each side, often interrupted, where incomplete their position being marked by papillae; transverse vessels irregularly branched, in places forming a perforated sheet medial to the stigmata; stigmata scattered, varying from oval slits to spiral infundibula, exhibiting complex anastomoses with other pharyngeal structures; external pharyngeal wall in places provided with branching bundles of mus-

cle fibers. Anal margin lobulate (Fig. 3*e*). Gonads situated in the intestinal loop and ramified over most of the inner and outer surfaces of the intestine.

DISCUSSION: This remarkable species is known with fair certainty only from Redikorzev's original material (7 specimens, Sea of Okhotsk) and from 3 small individuals from Teller and Point Hope, Alaska, reported by Van Name (1945). It differs from all other members of the genus in lacking a clear series of dorsal plates arranged with fair geometrical regularity and precision, the test instead being relatively smooth or dotted with scattered thickenings and protuberances. The latter are especially well developed in the present specimens, and, while irregular, do sometimes suggest a crude pattern consisting of a central intersiphonal plate (divided in the median sagittal

TABLE 5
Chelyosoma inaequale

STATION NUMBER	DIMENSIONS OF TEST (mm.)			NUMBER OF TENTACLES	DORSAL LANGUETS	INTERNAL LONGITUDINAL VESSELS	
	L	W	Ht			Right	Left
26	20	10	19	ca. 36 of 1st 2 orders; ca. 39 of 3rd and 4th orders	22, of 2 sizes	19	18
44	25	16	20	ca. 58 of 1st 2 orders; ca. 55 of 3rd order; 4th order very small, numerous, and irregularly placed	20	19	19
27	45	35	18	ca. 58 of 1st 2 orders; few scattered smaller tentacles	40	28–31	20–22



FIG. 3. *Chelyosoma inaequale*. a, Dorsal view of disc; b, oral siphon from anterior left side; c, dorsal tubercle and anterior dorsal languets; d, small area of pharynx, viewed from interior; e, anal margin.

plane in the largest specimen) flanked by 2 or 3 rows of peripheral plates. Internally the specimens agree favorably with Redikorzev's account, particularly in the unusual complexity of the pharyngeal wall. The only previous figure of the species is Redikorzev's sketch of the entire animal, which shows few details.

DISTRIBUTION: Sea of Okhotsk, west coast of Alaska off Teller and Point Hope (but see Van Name, 1945).

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